Remarks

Claims 1-45 were pending in the subject application. By way of this Amendment, claims 1, 38, 39, 40, 41, and 45 have been amended; and claims 18-24, 27-35, and 42-44 have been canceled. Accordingly, claims 1-17, 25, 26, 36-41, and 45 are currently before the Examiner.

Applicants gratefully acknowledge the telephonic election on November 21, 2001 and hereby affirm the election without traverse to prosecute claims 1-17, 25, 26, 36-41, and 45, without traverse.

The drawings have been objected to as failing to comply with 37 CFR §1.84(p)(5) because they included reference sign(s) not mentioned in the description. The specification has been amended as follows:

On page 3, section 9A, the Office Action states reference components **4A′**, **5A′**, **6A′**; **4B**, **5B**, **6B**, and **5A** are not mentioned in the applicants' disclosure. The applicants have amended the specification at page 11, lines 15-23, to include a description of the connections for connecting loops **4B**, **5B**, and **6B** to the switching networks shown in Figures 10 and 11, which makes mention of reference components **4A′**, **5A′**, **6A′**; **4B**, **5B**, **6B**, and **5A**.

On page 3, section 9B, the Office Action states reference components **7A′**, **8A′**, **9A′**; **7B**, **8B**, **9B**, and **8A** are not mentioned in the applicants' disclosure. The applicants have amended the specification at page 11, lines 15-23, to include a description of the connections for connecting loops **7B**, **8B**, and **9B** to the switching networks shown in Figures 10 and 11, which makes mention of reference components **7A′**, **8A′**, **9A′**; **7B**, **8B**, **9B**, and **8A**.

On page 4, section 9C, the Office Action states reference components **28**, **29**, and **30** are not mentioned in the applicants' disclosure. The specification has been amended at page 8, line 27, where "**23**, **24**, and **25**" have been replaced by "**28**, **29**, and **30**" to correct a typographical error.

On page 4, section 9D, the Office Action states reference components **34**, **35**, and **36** are not mentioned in the applicants' disclosure. The specification has been amended, at page 9, line 5, where "**23**, **24**, and **25**" have been replaced by "**34**, **35**, and **36**" to correct a typographical error.

On page 4, section 9E, the Office Action states reference component **13** is not mentioned in the applicants' disclosure. A proposed amendment to Figure 7 has been submitted with the proposed

amendments marked in red. The proposed amendment to Figure 7 shows reference component "13" has been deleted from Figure 7.

On page 4, section 9F, the Office Action states that reference components **19A**, **20A**, **21A**, **22A**, **21B**, and **22B** are not mentioned in applicants' disclosure. A proposed amendment to Figure 8 has been submitted with proposed amendments marked in red. The proposed amendment to Figure 8 makes the following substitutions, **22B→16B**, **20A→14A**, **19B→15B**, **20B→14B**, **21B→18B**, **21A→18A**, **19A→15A**, and **22A→16A**. This proposed amendment allows the use of reference components from Figure 9A, to be consistent with the description in the specification regarding Figure 8 at page 9, lines 8-9.

On page 4, section 9G, the Office Action states reference components **16A** and **18A** are mentioned in the applicants' disclosure. The specification, at page 10, line 17, has been amended to now make reference to **14A**, **15A**, **16A**, **17A**, and **18A**.

On page 4, section 9H, the Office Action states reference components **14A**, **15A**, and **17A** are not mentioned in applicants' disclosure. The specification, at page 10, line 17, and at page 11, line 5, has been amended to now make mention of reference components **14A**, **15A**, and **17A**. A proposed amendment to Figure 9B has been submitted with the proposed amendments in red. The proposed amendment shows 30A as the contacts for the Alderman-Grant coil. The amendment to the specification, at page 11, line 5, also includes "and **30A** shows the contacts for the Alderman-Grant coil."

On page 4, section 9I, the Office Action states reference components **C1**, **C2**, **C3**, and **C4** are not mentioned in applicants' disclosure. The specification, at page 9, line 24, has been amended to now make reference to C_1, C_2, C_3, and C_4 as four capacitive elements of the capacitive network shown in Figure 12.

On page 4, section 9J, the Office Action states reference components **72A**, **71A**, **70A**; and the five loop reference components **A**, **B**, **C**, **D**, and **E** are not mentioned in applicants' disclosure. The specification at page 13, line 5, has been amended to now make reference to **A**, **B**, **C**, **D**, and **E** as five loops oriently coaxially to one another. A proposed amendment to Figure 13 has been

submitted with proposed amendments in red. The proposed amendments to Figure 13 delete reference components **72A**, **71A**, and **70A** from Figure 13.

On page 4, section 9K, the Office Action states reference components **98** and **99** are not mentioned in the applicants' disclosure. The specification at page 10, line 10, has been amended to now make reference to **98** and **99** as reference points shown in Figures 15A, 15B, and 15C which illustrate points at which the current can change directions to produce the linear orthogonal modes or the opposite rotating mode.

On page 4, section 9L, the Office Action states reference components **I1**, **I2**, **R1**, **R2**, **x1**, **x2**, and **x0** are not mentioned in applicants' disclosure. The specification at page 14, lines 6-7, has been amended to now make reference to $\mathbf{I_1}$, $\mathbf{I_2}$, $\mathbf{R_1}$, $\mathbf{R_2}$, $\mathbf{X_1}$, $\mathbf{X_2}$, and $\mathbf{X_0}$. Page 14, line 16, of the specification has also been amended to replace "coil" with "coil pair" for consistency.

On page 5, section 10A, the Office Action states Figure 5 does not show loops **23**, **24**, and **25** as taught on page 8, line 27. Page 8, line 27 of the specification has been amended to replace "**23**, **24**, and **25**" with "**28**, **29**, and **30**".

On page 5, section 10B, the Office Action states Figure 6 does not show loops **23**, **24**, and **25** as taught on page 9, line 5. Page 9, line 5 of the specification has been amended to replace "**23**, **24**, and **25**" with "**34**, **35**, and **36**".

Accordingly, the applicants respectfully request removal of the objection to the drawings.

Claims 1-11, 13-17, 38-41, and 45 have been rejected under 35 USC 102(b) as being anticipated by Mehdizadeh *et al.* (U.S. Patent No. 4,918,388), or, in the alternative, under 35 USC 103(a) as obvious over Mehdizadeh *et al.* (U.S. Patent No. 4,918,388). Claims 1 and 41 has been amended to add the limitation "wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest". The applicants assert that the Mehdizadeh *et al.* ('388) reference does not teach or suggest the subject invention as claimed in amended claims 1 and 41. In fact, the Mehdizadeh *et al.* ('388) reference teaches away from the subject invention as claimed in amended claim 1. At column 1, lines 21-32, the Mehdizadeh *et al.* ('388) reference describes linearly polarized magnetic resonance coils which receives only one component of

magnetic resonance signals. At column 1, lines 33-46, the Mehdizadeh *et al.* ('388) reference describes quadrature coils, which has a circularly polarized magnetic field, and receives back orthogonal components of the rotating field, and at column 1, lines 62-64, states a thin quadrature surface coil is provided. In order to achieve a quadrature coil which receives back orthogonal components of the rotating field, the magnetic field associated with Helmholtz, D-pair **32** in Figures 6 and 7 and the magnetic field associated with coil **30** are substantially perpendicular with each other, not substantially parallel with each other. As the Office Action points out on page 7, the Mehdizadeh *et al.* ('388) Helmholtz, D-pair **32** is associated with the horizontal magnetic field and coil **30** is associated with the vertical magnetic field. Accordingly, the applicants assert the Mehdizadeh *et al.* ('388) reference does not teach or suggest a coil configuration as claimed in amended claim 1 of the subject invention, wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest.

With respect to claim 6, the applicants assert that with respect to the Mehdizadeh *et al.* ('388) reference each of the D-Pair or Helmholtz coil **32** and the coil **30** do not lie in planes parallel to each other. Rather, both of the D-Pair or Helmholtz coil **32** lie in the same plane (See Figure 3 and column 3, lines 66-67). With respect to claim 7, the applicants assert that with respect to the Mehdizadeh *et al.* ('388) reference the region of interest is not essentially within a cylinder created by the pair of coils, and further assert the D-Pair or Helmholtz coil **32** and the coil **30** are not coaxial. Rather than being coaxial, the coils of the D-Pair or Helmholtz coil **32** are coplanar (See Figure 3 and column 3, lines 66-67). With respect to claim 14, the applicants assert that Figure 2 of Mehdizadeh *et al.* ('388) is a diagrammatic illustration (See column 2, line 54) and not an actual physical coil configuration.

Accordingly, the applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-11, 13-17, and 41 under 35 USC §102(b) and 35 USC §103(a).

With respect to claims 38 and 45, the Office Action states that the Mehdizadeh *et al.* ('388) reference teach and suggest "A coil configuration for a magnetic resonance imaging system, comprising: a plurality of coils with bilateral symmetry" (See Figures 6, 7, and 9;), "wherein said

plurality of coils is associated with a plurality of modes" (*i.e.*, transmit and receive mode)". The applicants assert that transmit and receive mode are not the "modes" to which claims 38 and 45 are directed. Rather, as discussed in the specification at page 13, lines 1-4, and page 14, line 17 through page 15, line 22, as well as throughout the specification, "modes" with respect to the subject invention as claimed in claim 38 does not refer to transmit and receive mode, but, rather, each mode corresponds to a current pattern with respect to the plurality of coils. Therefore, applicants assert that the Mehdizadeh *et al.* ('388) reference does not teach each and every element of the subject invention as claimed in claims 38 and 45 such that a rejection under 35 USC §102 is improper and a *prima facie* case of obviousness has not been made such that a rejection under 35 USC §103 is improper. Accordingly, applicants respectfully request reconsideration and withdrawal of the rejection of claims 38-40 and 45 under 35 USC §102 and 35 USC §103(a).

Claims 1, 10, 12, 36, 37, 38-41, and 45 have been rejected under 35 USC 102(b) as being anticipated by Molyneaux (U.S. Patent No. 5,394,087), or, in the alternative, under 35 USC 103(a) as obvious over Molyneaux (U.S. Patent No. 5,394,087). Claims 1 and 41 have been amended to add the limitation "wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest". The applicants assert the Molyneaux reference does not teach or suggest the subject invention as claimed in amended claim 1. As with the Mehdizadeh *et al.* ('388) reference, the Molyneaux reference teaches away from the subject invention as claimed in amended claim 1, and, rather, teaches a quadrature coil. As stated in the Office Action at page 14, the Helmholtz coil taught by the Molyneaux reference is taught to be associated with the components parallel to the plane of the coil (*i.e.*, the <u>horizontal</u> magnetic field components) and loop coil **50** or loop coil $\mathbf{52_2}$ is taught to be associated with the components perpendicular to the plane of the coil (*i.e.*, the <u>vertical</u> magnetic field components). As the Molyneaux reference does not teach or suggest a coil configuration as claimed in amended claims 1 and 41 of the subject invention, wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest, the applicants respectfully request reconsideration and withdrawal of the rejection of claims 1, 10, 12, 36, 37, and 41 under 35 USC §102 and 35 USC §103.

With respect to claims 38 and 45, the Office Action states that the Molyneaux teaches and suggests "A coil configuration for a magnetic resonance imaging system, comprising: a plurality of coils with bilateral symmetry" (See Figures 2, 7, 8, 9, and 10;), "wherein said plurality of coils is associated with a plurality of modes" (*i.e.*, transmit and receive mode)". The applicants assert that transmit and receive mode are not the "modes" to which claims 38 and 45 are directed. Rather, as discussed in the specification at page 13, lines 1-4, and page 14, line 17 through page 15, line 22, as well as throughout the specification, "modes" with respect to the subject invention as claimed in claim 38 does not refer to transmit and receive mode, but, rather, each mode corresponds to a current pattern with respect to the plurality of coils. Therefore, applicants assert that the Molyneaux reference does not teach each and every element of the subject invention as claimed in claims 38 and 45 such that a rejection under 35 USC §102 is improper and a *prima facie* case of obviousness has not been made such that a rejection under 35 USC §103 is improper. Accordingly, applicants respectfully request reconsideration and withdrawal of the rejection of claims 38-40 and 45 under 35 USC §102 and 35 USC §103(a).

Claim 25 have been rejected under 35 USC §103(a) as being unpatentable over Mehdizadeh *et al.* (U.S. Patent No. 4,918,388).Claim 25 depends from claim 1 and applicants refer to the above discussion regarding the rejection of claim 1. The Office Action states, at page 19, that in Figures 6 and 7, Mehdizadeh *et al.* ('388) shows full black circles which the Examiner interprets as locations to which "electrical conductors" can be connected, and, therefore, it would have been obvious to one of ordinary skill in the art, at the time that the invention was made, that the "pair of coils" of Mehdizadeh *et al.* "are connected together by a pair of electrical conductors". The applicants refer to page 10, line 24 through page 11, line 9, and throughout the specification, as well as Figure 9B for a discussion of Alderman-Grant coil pair. Referring to Figure 9B with proposed amendment in red, coils **16B** and **18B** are connected by conductors **31** and **30**, with contacts **30A**. As described in the specification at page 10, line 29 through page 11, line 15, in the specific embodiment shown in Figure 9B, conductors **30** and **31** carry the same magnitude current in opposite directions; that the currents flowing in conductors **30** and **31** are split when the currents enter a coil, with one-half the

magnitude of current flowing in each half of the coil. The applicants assert the Office Action has not taught how this would be accomplished by "connecting together by a pair of electrical conductors the pairs of coils" of Mehdizadeh *et al.* ('388). Therefore, applicants assert that a *prima facie* case of obviousness with respect to claim 25 has not been presented. Accordingly, the applicants respectfully request reconsideration and withdrawal of the rejection of claims 25 under 35 USC §103.

Claim 26 have been rejected under 35 USC §103(a) as being unpatentable over Mehdizadeh *et al.* (U.S. Patent No. 4,918,388) and in view of Molyneaux (U.S. Patent No. 5,394,087). As discussed with respect to the rejection of claim 1 over Mehdizadeh *et al.* ('388) and the rejection of claim 1 over Molyneaux, claim 1 has been amended to add the limitation "wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest". The applicants assert the same arguments made with respect to the above rejection of claim 1 to the rejection of claim 26. In addition, the applicants point out that, referring to Figure 5 and column 5, lines 1-20, of the Mehdizadeh *et al.* ('388) reference, the jumper lead assemblies **108** and **110** are selectively set to select whether the signal for circuit **40** or from circuit **42** is shifted by 90°, allowing a choice of outputs depending on the direction of the main static magnetic field. In contrast, the switching means of the coil configuration of claim 26 allows the pair of coils and the single coil to operate in and switch between two or more of the modes . . . . Therefore, the applicants assert that a *prima facie* case of obviousness have not been presented and respectfully request reconsideration and withdrawal of the rejection under 35 USC §103.

Claims 38-40 and 45 have been rejected under 35 USC 102(b) as being anticipated by Vavrek *et al.* (U.S. Patent No. 5,311,135), or, alternatively claims 38-40 and 45 are rejected under 35 USC 103(a) as being unpatentable over Vavrek *et al.* (U.S. Patent No. 5,311,135). Claims 38-40 and 45 have been amended to now be directed to "A RF coil configuration . . ." with "coils" replaced with "RF coils" in claims 38-40 and 45. Support for this amendment can be found at least at page 5, line 29. In contrast, the Vavrek *et al.* reference teaches a gradient field coil. Therefore, Applicants assert that the Vavrek *et* al. reference does not teach each and every element of the subject invention

as claimed in claims 38 and 45 such that a rejection under 35 USC §102 is improper, and a *prima facie* case of obviousness has not been made such a rejection under 35 USC §103 is improper. Accordingly, applicants respectfully request reconsideration and withdrawal of the rejection of claims 38-40 and 45 under 35 USC §102 and 35 USC §103.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Applicant submits that the specification and claims are now in proper form, and that this application is now in condition for allowance, which action is respectfully solicited.

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 or 1.17 as required by this paper to Deposit Account 19-0065.

Applicant invites the Examiner to call the undersigned if clarification is needed on any aspect of this response, or if the Examiner believes there remains any valid ground upon which any claim in this application may be rejected subsequent to entrance of this amendment.

Respectfully submitted,

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JSP/srp
Attachment: Petition and Fee for Extension of Time.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

Page 8, lines 21-27 (amended):

Figure 5 shows an embodiment which incorporates top/bottom loops. In this embodiment coil **31** and coil **32** form a top coil pair and coil **33** and coil **34** form a bottom coil pair. Preferably, the coil pairs overlap such that mutual inductance between coil **32** and coil **33** and between coil **31** and coil **34** is low. Most preferably, the amount of overlap can be selected so as to achieve approximately zero mutual inductance. Additional coil pairs can be added and/or the coil pair(s) can be rotated with respect to the central axis of the cylinder formed by loops [**23, 24** and **25**] **28, 29, and 30**.

Page 8, lines 28-29 and page 9, lines 1-5 (amended):

Figure 6 shows an embodiment of the subject invention incorporating side by side loops. Loops **37** and **40** form one loop pair and loops **38** and **39** form another. Preferably the amount of overlap of side by side loop pairs is chosen so that the mutual inductance of the loops is low, and, more preferably, the amount of overlap is chosen so that the mutual inductance is approximately zero. Additional loops can be added to one or more side by side pairs and/or additional side by side pairs can be added. Again, the side by side pairs can be rotated with respect to the central axis of the cylinder formed by loops [**23, 24** and **25**] **34, 35, and 36.**

Page 9, lines 17-24 (amended):

With respect to the embodiments shown in Figure 7 and Figure 9A, Figure 12 illustrates a specific embodiment of a capacitive network which can be used to minimize or cancel mutual inductance between the single solenoid and the crossed ellipse. Referring to Figure 12, **10A** and **10A'** represent the contacts for ellipse **10B** and are analogous to contacts **14A** and **14A'** for ellipse

14B of Figure 9A; **12A** and **12A'** represent the contacts for loop **12B** and are analogous to contacts **17A** and **17A'** for loop **17B** of Figure 9A; and **11A** and **11A'** represent the contacts for ellipse **11B** and are analogous to contacts **15A** and **15A'** for ellipse **15B** of Figure [**9A**] 9A. C1, C2, C3, and C4 are four capacitive elements of the capacitive network shown in Figure 12.

Page 9, lines 25-29, Page 10, lines 1-23, and Page 11, lines 1-9 (amended):

In a specific embodiment, the crossed ellipse/opposite rotating configuration shown in Figure 8 can be simplified by the superposition of the [oppposite] opposite rotating mode on the crossed ellipse conductors as shown in Figure 15. In a specific embodiment, the two loops that form the opposite rotating mode in Figure 8 can be removed, and the opposite rotating mode can be superimposed onto the crossed ellipse. In this embodiment, the crossed ellipse configuration can support two linear orthogonal modes, one for each loop, and a third mode which represents the opposite rotating mode. Alternatively, the crossed ellipse configuration can support two linear orthogonal modes, each a superposition of individual modes associated with each of the two coils. The opposite rotating mode can be isolated from the two linear orthogonal modes due to zero mutual inductance. Referring to Figures 8, 15B, and 15C, loop [**19B**] 15B can produce a first linear mode **100** of the crossed ellipse, and loop [**20B**] 14B can produce a second linear mode **101** of the crossed ellipse which is orthogonal to the first mode. The opposite rotating mode **103** of the crossed ellipse is shown in Figure 15C where the crossed ellipses have been broken apart in a manner to emphasize the currents for producing the opposite rotating mode **103**. Reference points **98** and **99** shown on Figures 15A, 15B, and 15C illustrate points at which the current can change directions to produce two linear orthogonal modes or the opposite rotating mode. Coupling to the structure can be achieved through capacitive or inductive methods. If desired, the opposite rotating mode can be produced on a second crossed ellipse coil pair aligned with the first coil pair.

Referring to the embodiment of the subject invention shown in Figure 9A, coil **17B** can act as a solenoid around the center of the region of interest. Coils **14B** and **15B** can form crossed ellipse coils, and coils **16B** and **18B** can form an opposite rotating coil centered on coil **17B**. The opposite

rotating coil can be isolated via symmetry from coils **17B**, **14B**, and **15B**. 14A, 15A, 16A, 17A, and 18A show the contacts for the various coils. Coils **14B** and **15B** can be isolated from one another by , for example, having their axes perpendicular to each other. In this arrangement, Coil **17B** can have strong mutual inductance with both coils **14B** and **15B**. This inductance can be isolated by using one or more of various techniques known to those skilled in the art. The opposite rotating coil can have a zero flux in the center and improve the homogeneneity of the coverage by producing fields away from the center. Advantageously, the embodiment of Figure 9A can produce excellent homogeneity down the axis of the cylinder.

In another embodiment of the subject invention, as shown in Figure 9B, coil pair **16B** and **18B** can be modified so as to produce an Alderman-Grant (Alderman, D.W. and Grant, D.M., *Jo. Magnetic Resonance* **36**:447 [1979]) type of coil, such that coil **17B** is isolated from the Alderman-Grant coil due to the fields of the Alderman-Grant being perpendicular to the fields of coil **17B**. Such an Alderman-Grant coil can be achieved by adding a pair of conductors **30** and **31** to connect coils **16B** and **18B** such that conductors **30** and **31** carry the same magnitude current in opposite directions. The currents flowing in conductors **30** and **31** are split when the currents enter a coil, with one-half the magnitude of the current flowing in each half of the coil. For example, current flowing from conductor **30** flows one-half in each half of coil **18B** to conductor **31**, and current flowing from conductor **31** flows one-half in each half of coil **16B** to conductor **30**. 14A, 15A, and 17A show the contacts for the various coils, and 30A shows the contacts for the Alderman-Grant coil. In this embodiment, coils **17B** and the Alderman-Grant coil are isolated due to their perpendicular fields and coils **14B** and **15B** are isolated from one another by, for example, having their axes perpendicular to each other. Coil **17B** shares inductance and sample resistance with coils **14B** and **15B**, and the Alderman-Grant coil shares inductance and resistance with coil **14B** and **15B**.

Page 11, lines 15-23 (amended):

Figures 10 and 11 illustrate switching networks which can be utilized with respect to the three solenoid embodiment, for implementing a method to allow the opposite rotation of the loop

currents in either a series or parallel fashion. Figure 10 shows a switching network for allowing the outer two coils to have currents which either rotate in the same direction or in opposite directions. Referring to Figure 10, **1A'**, **2A'**, and **3A'** connect to the top contacts of loops **1B**, **2B**, and **3B** of Figure 1, while **1A**, **2A**, and **3A** connect to the bottom contacts. By closing switches **50** and **53**, loops **1B** and **3B** can be driven in the same rotation direction. By closing switches **51** and **52** and opening switches **50** and **53**, loops **1B** and **3B** can be driven in opposite rotation direction. <u>Analogously, **1A'**, **2A'**, and **3A'** of Figure 11 can connect to the top contacts of loops **4B**, **5B**, and **6B** (**4A'**, **5A'**, and **6A'**, respectively) of Figure 2, while **1A**, **2A**, and **3A** of Figure 11 connect to the bottom contacts (**4A**, **5A**, and **6A**, respectively). Analogously, **1A'**, **2A'**, and **3A'** of Figure 11 can connect to the top contacts of loops **7B**, **8B**, and **9B** (**7A'**, **8A'**, and **9A'**, respectively) of Figure 3, while **1A**, **2A**, and **3A**, of Figure 11 connect to the bottom contacts (**7A**, **8A**, and **9A**, respectively).</u>

<u>Page 13, lines 5-20</u> (amended):

Referring to Figure 13, five loops oriented co-axially to one another, with bilateral symmetry around the center loop <u>**A, B, C, D, and E**</u>, are shown. Bilateral symmetry means any loop on one side of the center loop is the same distance to the center loop as a similar loop on the other side of the center loop. These five coaxial loops can be used to produce five current patterns that have negligible mutual inductance between each pair of patterns in a region of interest. Three of these current patterns have even symmetry, while two have odd symmetry around the center loop. The odd symmetry patterns are required to have zero current in the center loop, since odd symmetry of currents means that a loop on one side of center has opposite rotating current to the similar loop on the other side of center. Even symmetry of current requires a loop on one side of center to have equal current in the same direction to a similar loop on the other side of center. All even symmetry patterns will inherently have zero mutual inductance with all odd symmetry patterns. Figures 14A and 14B show example field patterns down the central axis of the loops which can produced by certain current combinations for the loop configuration shown in Figure 13. The field patterns shown in Figures 14A and 14B illustrate how negligible mutual inductance can be produced between

various field patterns.

Page 14, lines 6-16 (amended):

Referring to Figure 16A, an external coil is shown at X_0 which can produce a non-uniform B-field at the position of a coil pair configuration, one coil at X_1 and a second coil at X_2. The coil at X_1 can have a radius R_1 and current I_1 while the coil at X_2 can have a radius R_2 and a current I_2. The coil pair can be adjusted such that the net electromagnetic force (EMF) caused by flux through the coils is zero, and, thus, net current is zero. In this way, the coil pair can be considered isolated from the external coil. By the principle of reciprocity, with such an arrangement, any B-field produced by the coil pair should produce a net B-flux through the external coil of zero as well. The coil pair can produce a B-field with a component that has a zero crossing in a plane through the external coil, as shown in Figure 16B. In this way, both positive and negative contributions to the total B-flux exist which cancel upon integration over said plane. This is what is referred to as a zero-flux contour. One skilled in the art will recognize that this is equivalent to saying that the said coil and the external coil pair have zero mutual inductance.

In the claims:

Claim 1 (amended):

A coil configuration for a magnetic resonance imaging system, comprising:

a pair of coils in an opposite rotation orientation associated with a first magnetic field in a region of interest, wherein the first magnetic field and the second magnetic field are substantially parallel in the region of interest; and

a single coil associated with a second magnetic field in the region of interest, wherein the single coil is positioned at an essentially zero-flux contour with respect to the first magnetic field.

Claim 38 (amended):

A RF coil configuration for a magnetic resonance imaging system, comprising:

a plurality of RF coils with bilateral symmetry,

wherein said plurality of RF coils is associated with a plurality of modes such that the number of modes is less than or equal to the number of RF coils, wherein said plurality of modes correspond with a plurality of current patterns, each of said plurality of current patterns having zero net mutual inductive coupling to each of the other of said plurality of current patterns in a region of interest.

Claim 39 (amended):

The configuration according to claim 38, further comprising:

a means for utilizing the plurality of RF coils for detecting magnetic fields associated with the plurality of current patterns.

Claim 40 (amended):

The configuration according to claim 38, further comprising:

a means for utilizing the plurality of RF coils for generating magnetic fields

associated with the plurality of current patterns.

Claim 41 (amended):

A method of detecting magnetic fields in a magnetic resonance imaging system, comprising the following steps:

detecting a first magnetic field in the field of interest utilizing a pair of coils in an opposite rotation orientation associated with the first magnetic field in a region of interest, wherein the first magnetic field and the second magnetic field are essentially parallel in the region of interest; and

detecting a second magnetic field in the region of interest utilizing a single coil associated with the second magnetic field in the region of interest,

wherein the single coil is positioned at an essentially zero-flux contour with respect to the first magnetic field.

Claim 45 (amended):

A method of detecting magnetic fields in a magnetic resonance imaging system, comprising the following steps:

positioning a plurality of RF coils with respect to a region of interest such that the plurality of RF coils support a plurality of modes corresponding to a plurality of current patterns; and

detecting the plurality of modes associated with the plurality of RF coils,

wherein the number of RF coils is greater than or equal to the number of modes, and wherein each of the plurality of current patterns has zero net mutual inductive coupling to each of the other of the plurality of current patterns in a region of interest.